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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/069,031	07/05/2002	Johannes Kaeppler	24230PCT/US	7779

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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1722

DATE MAILED: 03/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/069,031	<b>Applicant(s)</b> KAEPELER ET AL.	
	<b>Examiner</b> Matthew J. Song	<b>Art Unit</b> 1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 August 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 40-66 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 40-66 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/5/2005 has been entered.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 46, 47, 50-51, 54, 56, and 60-63 are rejected under 35 U.S.C. 102(b) as being anticipated by Wengert et al (WO 97/06288A1).

In an apparatus for chemical vapor deposition of semiconductor wafers, note entire reference, Wengert et al discloses a reaction chamber 130 with a plurality of radiant heat lamps are arranged around the reaction chamber to heat a susceptor 134 and a wafer 144 (pg 15, ln 15-36), this reads on applicant's heating on all sides of the reactor. Wengert et al also discloses a gas injector 156 is positioned upstream of a process chamber 130 and includes a plurality of reactant gases flow horizontally 112 (pg 16, ln 10-35 and Fig 8), this reads on applicant's at least one

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process or carrier gas is introduced just ahead of the substrate. Wengert et al also disclose a plurality of heat lamps heat the susceptor (pg 15, ln 25-35), this reads on applicant's holder is actively heated during the heating of the substrate. Wengert et al discloses a gas injector 156 includes water cooling channels and intended to maintain the temperature of the material for the gas injector at approximately 60°F or cooler (pg 23, ln 1-30), this reads on applicant's actively cooling a process gas before being introduced into the reactor to a temperature which is well below the process temperature.

Referring to claim 46, Wengert teaches a heated reactor (Fig 27), this reads on applicant's actively heated flow channel, a rotatable susceptor (Abstract), an inlet 374 just ahead of the susceptor (Fig 27), an outlet (Fig 28a), a horizontal flow (Fig 27), a heater 378a, 378b. Wengert also teaches thermocouples 102 to sense temperature, which allows comprehensive feedback regarding temperature and enables adjustment of the radiant heating lamps surrounding the chamber, this reads on applicant's temperature control device. Wengert discloses cooling channels within a gas injector, this reads on applicant's coolable gas inlet. The radiant heating lamps are capable of performing the claimed intended use of heating to 1100-1800°C.

Referring to claim 47, Wengert discloses a rotationally symmetric inlet and outlet (Fig 28a).

Referring to claim 50, Wengert discloses a rotatable susceptor. (Abstract).

Referring to claim 51, the limitations further limit only the intended use of the temperature controller. The apparatus taught by Wengert et al is capable of performing the claimed intended use; therefore reads on the claim.

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Referring to claim 54, Wengert discloses quartz and graphite, this reads on applicant's highly conductive material.

Referring to claim 56, Wengert discloses a liquid medium.

Referring to claims 60-61, Wengert discloses a boundary wall which is capable of being cooled.

Referring to claim 62, Wengert discloses two substrates.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 40-45, 49, and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wengert et al (WO 97/06288 A1) in view of Burk (US 5,788,777).

In an apparatus for chemical vapor deposition of semiconductor wafers, note entire reference, Wengert et al discloses a reaction chamber 130 with a plurality of radiant heat lamps are arranged around the reaction chamber to heat a susceptor 134 and a wafer 144 (pg 15, ln 15-36), this reads on applicant's heating on all sides of the reactor. Wengert et al also discloses a gas injector 156 is positioned upstream of a process chamber 130 and includes a plurality of reactant gases flow horizontally 112 (pg 16, ln 10-35 and Fig 8), this reads on applicant's at least one process or carrier gas is introduced just ahead of the substrate. Wengert et al also disclose a plurality of heat lamps heat the susceptor (pg 15, ln 25-35), this reads on applicant's holder is actively heated during the heating of the substrate. Wengert et al discloses a gas injector 156 includes water cooling channels and intended to maintain the temperature of the material for the gas injector at approximately 60°F or cooler (pg 23, ln 1-30), this reads on applicant's actively cooling a process gas before being introduced into the reactor to a temperature which is well below the process temperature.

Wengert et al discloses a general chemical vapor deposition apparatus. Wengert et al does not teach deposition of SiC, SiCGe, Al, or GaN by heating a substrate to a temperature of 1100-1800°C.

Burk teaches a modified susceptor for epitaxial growth reactors for growing silicon carbide epitaxial layers. The susceptor assembly has multiple substrate holders which are levitated and rotated by an inert gas flow (Abstract), this reads on applicant's gas foil rotation. Burk teaches the susceptor deals with the problems of cracking of the susceptor because higher temperatures, 1450-1700°C, are required for SiC deposition (col 1, ln 30-60). Burk also teaches the susceptor is made of graphite, SiC or SiC coated graphite (col 4, ln 10-12).

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It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wengert et al by heating the substrate to 1450-1700°C to epitaxially form SiC, which is a useful semiconductor material, as taught by Burk ('777 col 1, ln 1-55).

Referring to claim 41, the combination of Wengert et al and Burk teach a substrate holders which are levitated and rotated by an inert gas flow which avoid cracking problems, this reads on applicant's gas foil rotation.

Referring to claim 42, the combination of Wengert et al and Burk teaches using silane and propane as reactant gases to form SiC ('777 col 2, ln 45-60).

Referring to claim 43, the combination of Wengert et al and Burk teaches maintaining temperature uniformity over the wafer ('288 pg 27, ln 10-15); therefore the high growth rates would have been obvious to one of ordinary skill at the time of the invention because higher growth rates increase productivity.

Referring to claim 44, the combination of Wengert et al and Burk teaches low temperature gradients ('288 pg 27, ln 10-15).

Referring to claim 45, the combination of Wengert et al and Burk does not teach the claimed pressure. However, pressure is well known in the art to be a result effective variable; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wengert et al and Burk by optimizing the pressure to obtain the claimed pressure by conducting routine experimentation.

Referring to claim 57, means such as an adapter piece would have been obvious to one of ordinary skill at the time of the invention to control flow.

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6. Claims 48, 55, 58-59, and 64-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wengert et al (WO 97/06288 A1) as applied to claims 46, 47, 50-51, 54, 56, and 60-63 above, and further in view of Flynn et al (US 6,447,604).

Wengert et al discloses all of the limitations of claim 48, as discussed previously, except the substrate holder having a continuous inert coating such as TaC or NbC.

Flynn et al discloses a method of reducing defects and thereby improving the quality of epitaxial layers formed in a reactor by vapor phase epitaxy (i.e. CVD). Process conditions include temperatures of from 500-1250°C and pressure from 1-1000 torr. Materials grown include AlN and GaN (abstract). Flynn et al also discloses TaC and NbC inert coating are made on the susceptor and reactor parts. (col 7, ln 50-60).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wengert et al by coating the susceptor and reactor with TaC or NbC to help reduce defects present in GaN.

Referring to claims 58-59, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify to use different inert materials in the outlet segments and on the substrate holder because at least two inert materials were known (TaC and NbC) and described as alternative. Those of ordinary skill in the art would have expected different materials to have different properties.

Referring to claim 63, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the prior art by using graphite because graphite is a well known material of construction which efficiently transfers heat, which is desirable.



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7. Claims 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wengert et al (WO 97/06288 A1) as applied to claims 46, 47, 50-51, 54, 56, and 60-63 above, and further in view of Hirata et al (US 4,542,273).

Wengert et al discloses all of the limitations of claim 53, as discussed previously, except the boundary wall heating by two separate circuits.

Hirata et al discloses heating with multiple circuits. (col 1, ln 1-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wengert et al by using two circuits for induction heating for independent control and because it is less costly (col 1, ln 10-25).

8. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wengert et al (WO 97/06288 A1) as applied to claims 46, 47, 50-51, 54, 56, and 60-63 above, and further in view of Crawley et al (US 5,871,586).

Wengert et al discloses all of the limitations of claim 52, as discussed previously, except a combination of high frequency, lamp and resistance heating means.

In an apparatus for MOCVD, note entire reference, Crawley et al teaches heating systems which include induction heating, radiation heating or resistance heating as desired. (Col 3, ln 40-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wengert by using a combination of known heating means, as taught by Crawley et al, because a combination of known equivalents is held to be obvious. (MPEP 2144.06).

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***Response to Arguments***

9. Applicant's arguments with respect to claims 40-66 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song  
Examiner  
Art Unit 1722

MJS  
March 19, 2006

DUANE SMITH  
PRIMARY EXAMINER  
12-  
3-20-06